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MAN-SYSTEMS DIVISION

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MAN-SYSTEMS DISTRIBUTED SYSTEM

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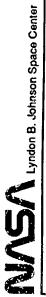
SPACE STATION FREEDOM

OVERVIEW

MAN-SYSTEMS DIVISION

J. L. LEWIS, PhD / SP

- 1. DESCRIPTION OF MAN-SYSTEMS
- DEFINITION
- REQUIREMENTS
- SCOPE
- SUBYSTEMS
- TOPOLOGYS
- 2. IMPLEMENTATION
 - **APPROACH** TOOLS
- 3. MAN-SYSTEMS INTERFACES
 - SYSTEM TO ELEMENT
 - SYSTEM TO SYSTEM
- 4. PRIME/SUPPORTING DEVELOPMENT RELATIONSHIP
- 5. SELECTED ACCOMPLISHMENTS
- 6. TECHNICAL CHALLENGES



MAN-SYSTEMS: DEFINITION

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MAN-SYSTEMS DIVISION

CREW INTERFACES WITH SYSTEMS AND EQUIPMENT

- REQUIREMENTS DEFINITION AND INTEGRATION
- HARDWARE
- DESIGN, DEVELOPMENT, TEST, AND EVALUATION
- SUBSYSTEM MANAGEMENT
- OPERATIONAL SUITABILITY ASSESSMENT



MAN-SYSTEMS REQUIREMENTS

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PROGRAM LEVEL DOCUMENTS

- PROGRAM DEFINITION REQUIREMENTS DOCUMENT, SSP 30000
- MAN-SYSTEMS, SSP 30257 ARCHITECTURAL CONTROL DOCUMENT:
 - BASELINE CONFIGURATION DOCUMENT
 - HAB MODULE
- LAB MODULE
- LOG MODULE
 - NODES
- AIPLOCK
 - TRUSS
- INTERFACE REQUIREMENTS DOCUMENTS
 - ELEMENT-TO-ELEMENT
- SYSTEM-TO-SYSTEM
- SYSTEM-TO-ELEMENT
- MAN-SYSTEMS INTEGRATION STANDARD, NASA STANDARD 3000, VOL IV

PROJECT LEVEL DOCUMENTS

- 31000 PRD, JSC : SRD-0001
- ELEMENT CEI SPECIFICATIONS

SYSTEMS INTEGRATION MANAGEMENT DOCUMENTS

- MAN-SYSTEMS INTEGRATION PLAN
- CREW COMPARTMENT CONFIGURATION DRAWING
 - HUMAN COMPUTER INTERFACE GUIDE
- DATA BASE DEVELOPMENT AND CONFIGURATION MANAGEMENT

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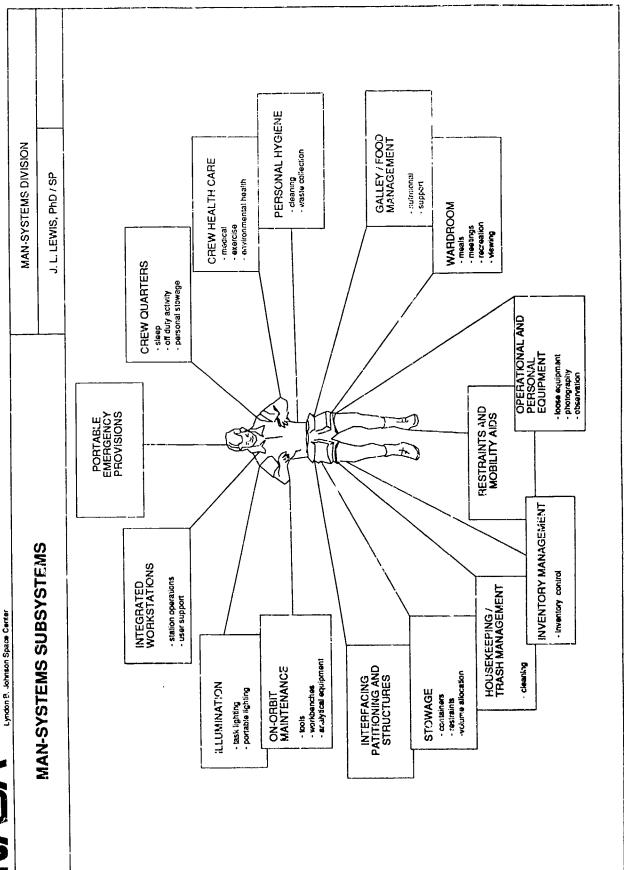
Lyndon b. Johnson Space Center	
MANICVETEMS: 600BE	MAN-SYSTEMS DIVISION
MAIN-3131 EMIS. SCOPE	J. L. LEWIS, PhD / SP
MAN-SYSTEMS DISCIPLINE PERSONNEL DEFINE AND INTEGRATE MAN-SYSTEMS REQUIREMENTS THE RAN-SYSTEMS MAN-SYSTEMS THE MAN-SYSTEMS DISCIPLINE INCLUDES TERMS VARIOUSLY REFERED TO AS HUMAN FACTORS, HUMAN ENGINEERING, ERGONOMICS, MAN-MACHINE INTERFACE, AND MAN-MACHINE ENGINEERING.	ND INTEGRATE MAN-SYSTEMS L ELEMENTS. THE OUSLY REFERED TO AS OMICS, MAN-MACHINE
IN ADDITION, MAN-SYSTEMS TECHNICALLY MANAGES:	GES:
MAN-SYSTEMS HARDWARE DEVELOPMENT AND ASSOCIATED HUMAN ENGINEERING	WP-01
FLIGHT CREW INTEGRATION CREW HEALTH CARE SYSTEM DEVELOPMENT NODE AND CUPOLA OUTFITTING	WP-02
FLIGHT TELEROBOTICS SERVICER • WORKSTATION DEFINITION • CREW INTEGRATION • OPS SUITABILITY ASSESSMENT	WP-03
AS SUPPORTING DEVELOPMENT MAN-SYSTEMS FURNISHES:	RNISHES:

INTEGRATION AND ANALYSIS

CREW EQUIPMENT

MOCKUPS AND TRAINERS





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MAN-SYSTEMS ARCHITECTURAL CONSIDERATIONS

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Fabric liners for General area isolation, acoustic upper stand-c attenuation orientation cu

General area lighting in upper stand-offs provide orientation cue Aisle partition

Crow quarters low activity zone passageway

Personal hygiene functional units with reconfigurable aisle extension Firm walls.
celling and
floors
enhance
architectural
continuity,
facilitate

Center aisle facilitate restraint and mobility

Distributed system interfaces mounted in stand-offs

Standard rack restraint interface

Horizonvie:k window

406 MAN-SYSTEMS DIVISION J. L. LEWIS, PhD / SP Statuto Mayo **BENOVS** 53,45 HABITATION MODULE WOODDIEN.

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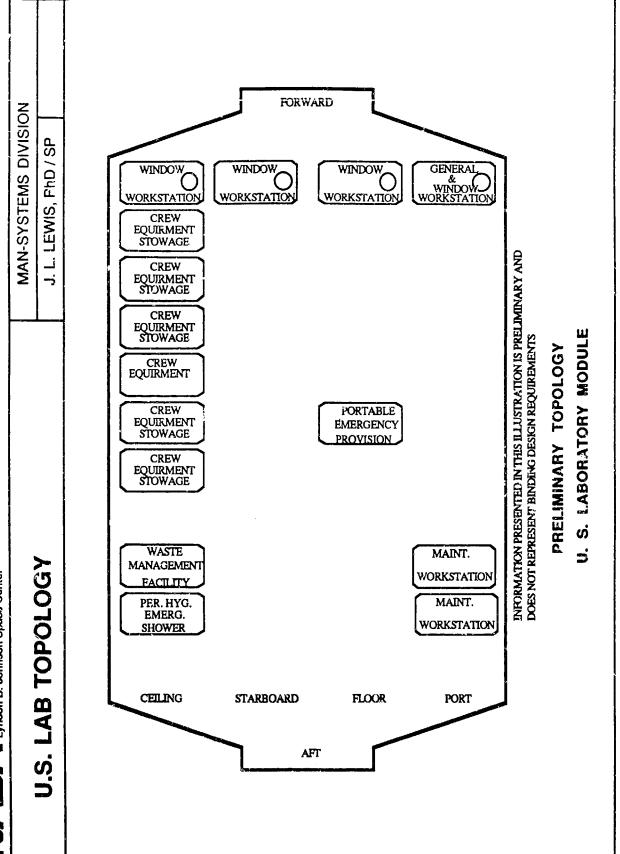
MAN-SYSTEMS DIVISION JIM LEWIS eneight knosted MAN-SYSTEMS, LABORATORY MODULE (TYPICA!!) Containing M. Element Control Customar Custo Lyndon B. Johnson Spacs Center

Lyndon B. Johnson Space Center

MAN-SYSTEMS DIVISION Cupola Integrated Workstation J. L. LEWIS, PhD / SP Stowage MAN-SYSTEMS SUBSYSTEMS Requirements Definition and Requirements Integration Command and Control Integrated Node (typical)

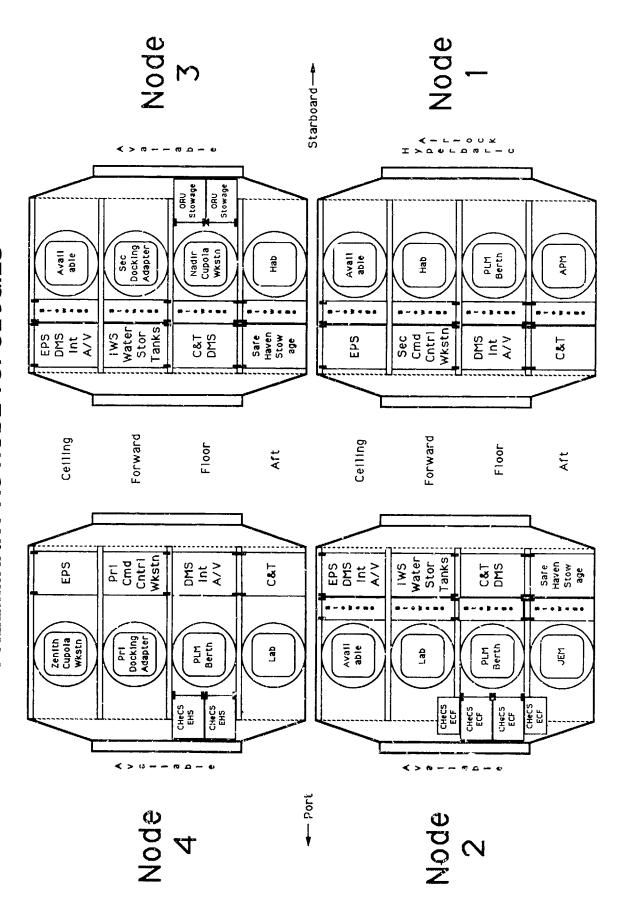
AFT CEILING FLOOR PORT STARBOARD HOUSEKEEPING MAN-SYSTEMS DIVISION GALLEY WASH/DRY FOOD PREP. WARDRO DISH WASHER STOWAGE J. L. LEWIS, PhD / SP STOWAGE GALLEY GALLEY FOOD PREP. WARDROOM REFRIGERATOR STOWAGE STOWAGE FREEZER GALLEY INFORMATION PRESENTED IN THIS ILLUSTRATION IS PRELIMINARY AND DOES NOT REF "ESENTBINDING DESIGN RECAUREMENTS WARDROOM TRASH MGMT. STOWAGE VIEWING SHOWER LOCKER FACILITY FILM STATION PRELIMINARY TOPOLOGY HABITATION MODULE PERSONAL HEALTH HYGIENE MAINT. FACILITY FACILITY WASTE HEALTH MAINT. MGMT. FACILITY FACILITY HEALTH CREW EQUIP CREW EQUIP. MAINT. FACILITY STOWAGE STOWAGE STOWAGE CREW EQUIP. CREW EQUIP. CREW EQUIP. CREW EQUIP. STOWAGE STOWAGE STOWAGE STOWAGE Lyndon B. Johnson Space Center CREW CREW CREW CREW QUARTERS QUARTERS QUARTERS QUARTERS U.S. HAB TOPOLOGY CREW CREW CREW CREW QUARTERS QUARTERS QUARTERS QUARTERS STOWAGE STOWAGE STOWAGE STOWAGE CREW CREW CREW CREW QUARTERS QUARTERS QUARTERS QUARTERS FORWARD





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PRELIMINARY AC NODE TOPOLOGIES



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IMPLEMENTATION: APPROACH

MAN-SYSTEMS DIVIS,ON
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TO PROVIDE PERSONNEL, TOOLS, AND FORUMS TO FACILITATE

THE INTEGRATION OF ALL CREW INTERFACES ACROSS ALL SPACE

STATION ELEMENTS AND SYSTEMS SO AS TO INCREASE CREW

SAFETY AND PRODUCTIVITY.

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IMPLEMENTATION: TOOLS

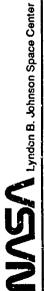
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MAN-SYSTEMS INTEGRATED TEST BED

- WEIGHTLESS ENVIRONMENT TRAINING FACILITY
- NEUTRAL BUOYANCY LABORATORY
- SPACE STATION MOCKUP AND TRAINER FACILITY
- MOBILE REMOTE MANIPULATOR DEVELOPMENT FACILITY

HUMAN COMPUTER INTERFACE LABORATORY

- DEFINES REQUIREMENTS FOR OPTIMIZED INTERACTIONS BETWEEN **HUMANS AND COMPUTERS**
- WORKSTATION DESIGN
- DISPLAY CONTENT AND FORMAT AND USE OF TEXT AND GRAPHICS



MAN-SYSTEMS DIVISION J. L. LEWIS, PhD / SP IMPLEMENTATION: TOOLS

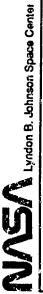
GRAPHICS ANALYSIS FACILITY

- FLIGHT OPERATIONS, VEHICLE AND PAYLOAD DESIGN, AND MISSION PLANINING PERFORMS SYSTEMS ENGINEERING ANALYSES OF MAN-MACHINE INTERFACES,
- UTILIZES INTERACTIVE CUSTOMIZIED 3-D COMPUTER GRAPHICS PACKAGE (PLAID)
- INCLUDES UNIQUE MAN-MODELING SOFTWARE WITH EXTENSIVE ANTHROPOMETRIC DATA BASE

ANTHROPOMETRIC AND BIOMECHANICS LABORATORY

- QUANTIFIES HUMAN PERFORMANCE CAPABILITIES UNDER SHIRTSLEEVED AND SPACESUITED CONDITIONS
- MEASURES STRENGTH AND MOTION IN ONE-G AND SIMULATED ZERO-G CONDITIONS (VIA NEUTRAL BUOYANCY AND KEPLERIAN FLIGHT)
- MEASURES STATIC AND DYNAMIC ANTHROPOMETRY (STATURE AND REACH ENVELOPES)

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LIGHTING LABORATORY

- PERFORMS ANALYSES OF FACTORS RELEVANT TO THE ASTRONAUT'S ENVIRONMENT
- AMBIENT AND SPECIAL LIGHTING NEEDS ARE ACCESSED FOR BOTH IVA AND EVA ACTIVITIES
 - EVALUATES DESIGN CONCEPTS FOR LIGHTS, ALIGNMENT AIDS, DOCKING TARGETS, ETC.

MAN-SYSTEMS TELEROBOTICS LABORATORY

- PERFORMS RESEA 3CH CONCERNING HUMAN INTERFACES WITH MANIPULATOR/TELEROBOTIC/ROBOTIC SYSTEMS
- SUPPORTS DEVELOPMENT OF THE FLIGHT TELEROBOTIC SERVICER PROGRAM
 - AND DESIGN EVALUATIONS FOR TELEROBOTIC WORKSTATIONS, ROBOT DEVELOPS MAN-MACHINE REQUIREMENTS, CONCEPTUAL DESIGN INPUTS, DESIGN, AND ROBOT SENSOR SYSTEMS



MAN-SYSTEMS DIVISION J. L. LEWIS, PhD / SP IMPLEMENTATION: TOOLS

FOOD SYSTEMS ENGINEERING FACILITY

- DEVELOPMENT OF SPACE STATION FOOD SYSTEM AND ANCILLARY EQUIPMENT
 - DEVELOPIMENT OF FOOD PRESERVATION TECHNIQUES, EXTENDED SHELF LIFE FOOD HANDLING EQUIPMENT DESIGN, AND PROCESSING AND PACKAGING STUDIES, OPTIMUM STORAGE METHODS, FOOD HEATING TECHNOLOGY, **TECHNIQUES**

ELECTRONIC STILL CAMERA LABORATORY

- RESEARCH AND DEVELOPMENT OF HIGH RESOLUTION DIGITAL CAMERA SYSTEM
- FABRICATION AND TESTING OF PROTOTYPE AND PROTOFLIGHT DIGITAL CAMERA SYSTEMS
- DEVELOPMENT OF IMAGE PROCESSING SYSTEMS TO SUPPORT THE HIGH RESOLUTION DIGITAL CAMERA SYSTEM

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IMPLEMENTATION: TOOLS

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PERSONAL HYGIENE/HOUSEKEEPING LABORATORY

- DEVELOPMENT OF PERSONAL HYGIENE/HOUSE KEEPING SOFTGOODS AND CONSUMABLES
- DEVELOPMENT OF THE PERSONAL HYGIENE/HOUSE KEEPING ASSOCIATED HARDWARE
 - ONE-G AND ZERO-G TESTING OF THE HARDWARE AND ASSOCIATED CONSUMABLES

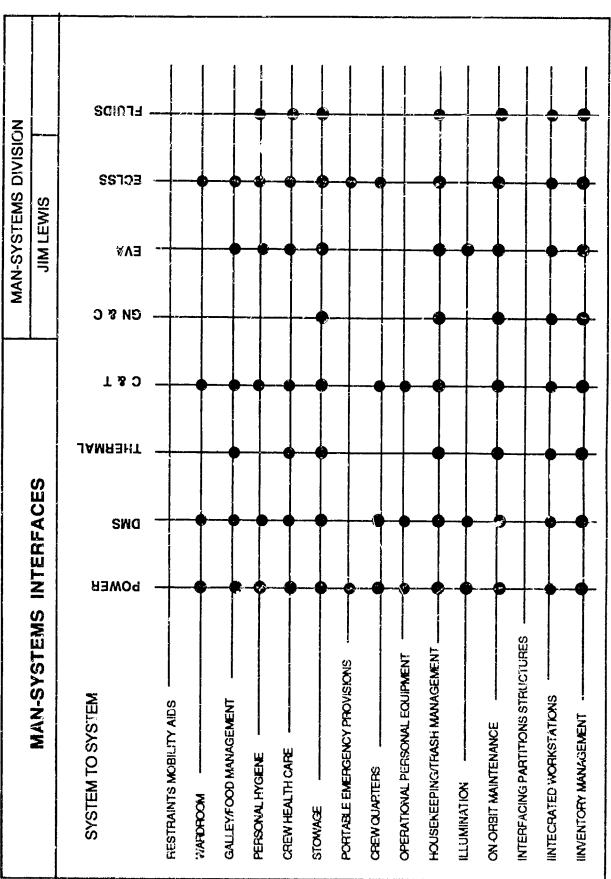


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MAN-SYSTEMS INTERFACES	ACES					JIM LEWIS	Si		
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RESTRAINTS MOBILITY AIDS	-	-			•			•	
WARDHOOM			•						
GALLEY/FOOD MANAGEMENT	-							-	
PERSONAL HYGIENE	-	-			-		1	-	
CREW HEALTH CARE	•	•			•	•	•		
STOWAGE	•	•	•	•	-	+	•	•	
PORTABLE EMERGENCY PROVISIONS	-	•	-	-					
CREWQUARTERS	•	-	•					-	
OPERATIONAL PERSONAL EQUIPMENT	-	-	-	•	•		•		
HOUSEKEEPINKYTRASH MANAGEMENT	-	•	-	-	-	•	•	•	
ILLUMINATION	•	+	•			•	-	•	
ON-ORBIT MAINTENANCE	•	•	•	•	•	•	•		
INTERFACING PARTITIONS STRUCTURES	-	+	-	•			•		
INTEGRATED WOPKSTATIONS	-	•	-	•	•	\		•	
#MENTORY MANAGEMENT	•				•		-	-	
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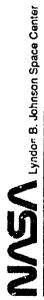
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	TRIME/SOFFCALING DEVELOPMENT RELATIONSHIP	טרשהאי ההוא.	Title		JIM LEWIS		
	SUBSYSTEMS	SSM	WP 01	WP 02 JSC	WP 03 GSFC	SPRT DEV	J.LNI
-	CHEW QUARTERS	L WEAVER	×			×	
N	RESTRAINTS & MOBILITY AIDS	J. BOHANNON	×	×		×	×
ო	CE EW HEALTH CARE	J. ELLIS		×		×	
4	OPS & PERSCAAL EQUIPMENT	J. THOMAS/T. FLETCHER	ER X	×		×	×
νo	PORTABLE EMERGENCY PROVISIONS	J. NOELKE	×	×		×	×
9	NTEGRATED WORKSTATIONS	D. JENSEN	×	×	×		×
7	GALLEY/FOOD MANAGEMENT	H. RIEMERS/C. BOURLAND	X ON			×	
0 0	PERSONAL HYGENE	P. GHOUNDS	×			×	×
o,	ILLUMINATION	WHEELIVERGHTADNES	×	×		×	×
0	WARDROOM	R.JONES/N.PAUSBACK	×			×	
-	STOWAKE	J. LEWJ. MADIGAN	×	×		×	×
12	HOUSEKEEPING/THASH MANAGEMENT	H. RIEMERS	×	×		×	×
13	INTERFACING PARTITIONS	R. JONES	×	×		×	Z
4	IN-FLIGHT MAINTENANCE	F. MOUNT	×	×		×	×
<u>ب</u> بن	INVENTORY MANAGEMENT	J. LEWW. PRAUS	×	×		×	×



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MS DIVISION	LEWIS PhD / SP	
MAN-SYSTEMS DIVISION	J. L. LEWIS, PhD / SP	
SELECTED ACCOMPLISHMENTS		

PROTOFLIGHT ANALYSIS KC-135 ZERO G

- SHOWER
- RESTRAINTS DESIGN EVALUATION

MAN-SYSTEMS INTEGRATION TEST BED

- WETF EVALUATIONS
- EVA SUIT EVALUATIONS UTILITY REEL/TRAY EVALUATION

AIRLOCK EVALUATIONS

- TRUSS ASSEMBLY
- G MOCKUPS
- CUPOLA EVALUATION
- INTERIOR DESIGN EVALUATIONS

- VIEWING ANALYSIS
- ASSEMBLY SEQUENCE

INTEGRATION STANDARDS

- MAN-SYSTEMS INTEGRATION STANDARDS NASA STD 3000, VOL IV
 - HUMAN COMPUTER INTERFACE GUIDE

INTERNAL ARCHITECTURE

- EXTENSIVE EVALUATION TO ESTABLISH BASIC LAYOUT
 - DEVELOPED AND IMPLEMENTED MODULAR CONCEPTS

CARPENS AND MANAGES THE



	MAN-SYSTEMS DIVISION
TECHNICAL CHALLENGES	J. L. LEWIS, PhD / SP
INTEGRATION OF MAN-SYSTEMS REQUIREMENTS	IREMENTS
ACROSS ALL SPACE STATION FREEDOM ELEMENTS	M ELEMENTS

The construction of the co